

N 87 - 24504

**HOOP/COLUMN AND TETRAHEDRAL TRUSS
ELECTROMAGNETIC TESTS**

**M. C. Bailey
NASA Langley Research Center
Hampton, Virginia**

SURFACE DISTORTION FOR HOOP/COLUMN REFLECTOR ANTENNA

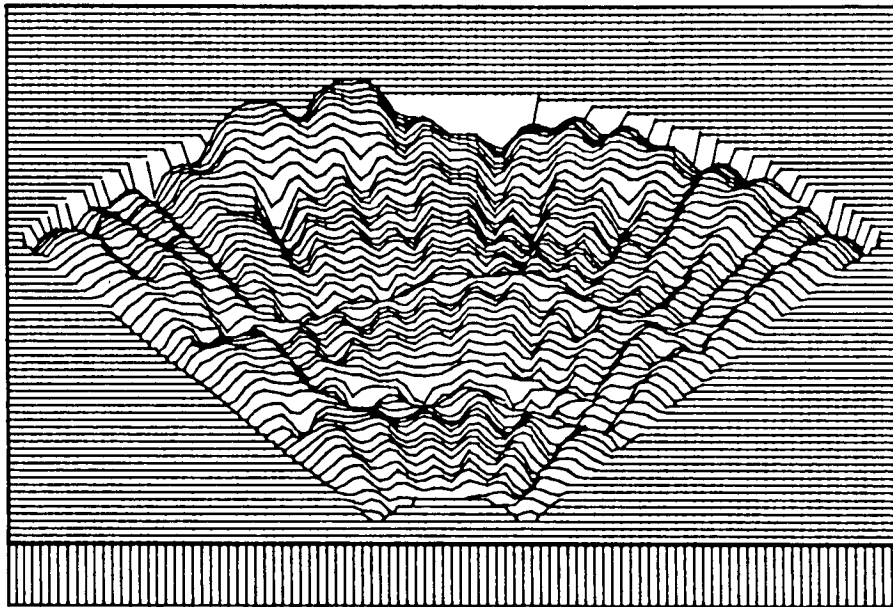
The distortion of the hoop/column antenna was measured with a metric camera system at discrete target locations on the surface. This figure shows a plot of the deviation from a perfect paraboloidal surface for one quadrant of the hoop/column reflector. The height of the distortion is amplified on the plot in order to show the surface features.

(QUADRANT-4)

(RMS = 0.167 CM)

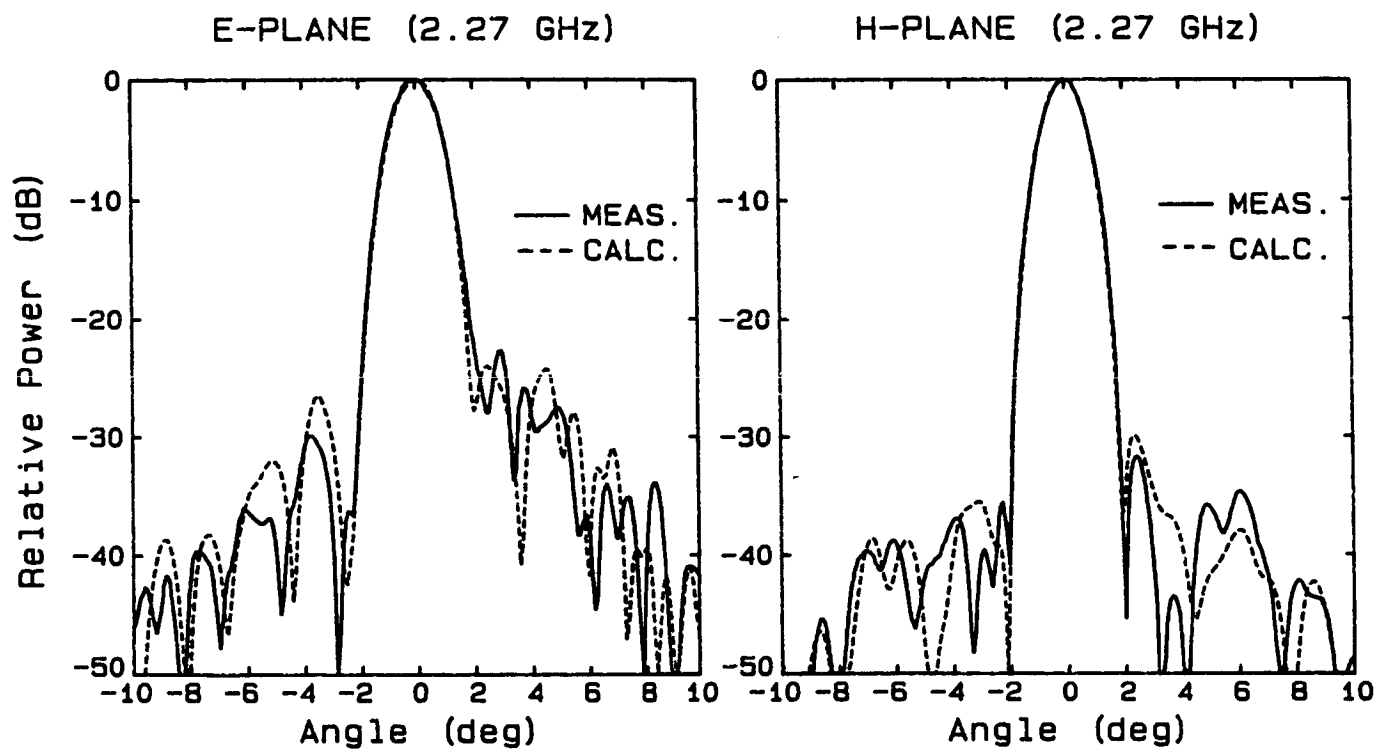
MAXIMUM = +0.50 centimeter

MINIMUM = -0.80 centimeter



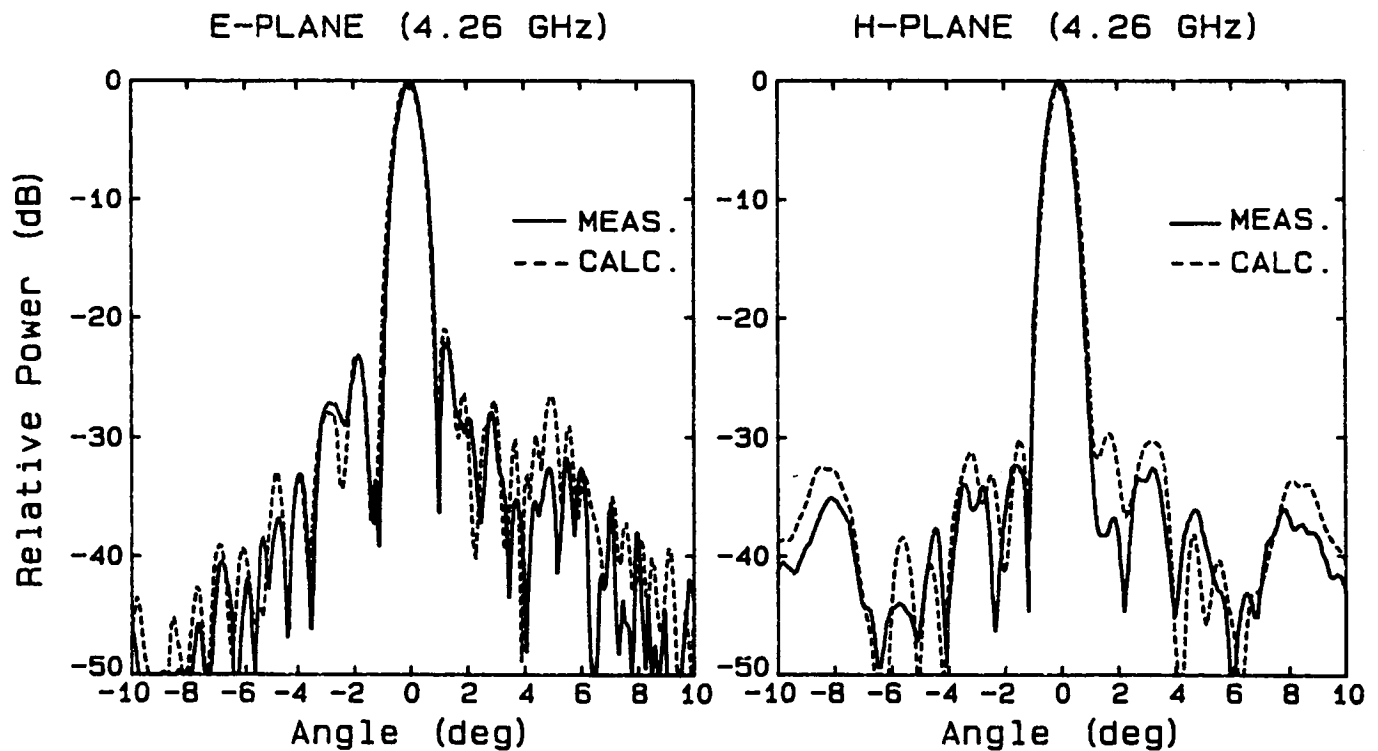
2.27-GHZ RADIATION PATTERNS FOR THE HOOP/COLUMN ANTENNA

The E-plane and H-plane radiation patterns are presented in this figure at 2.27 GHz. At this low frequency, the performance of the antenna is almost the same as a smooth surface.



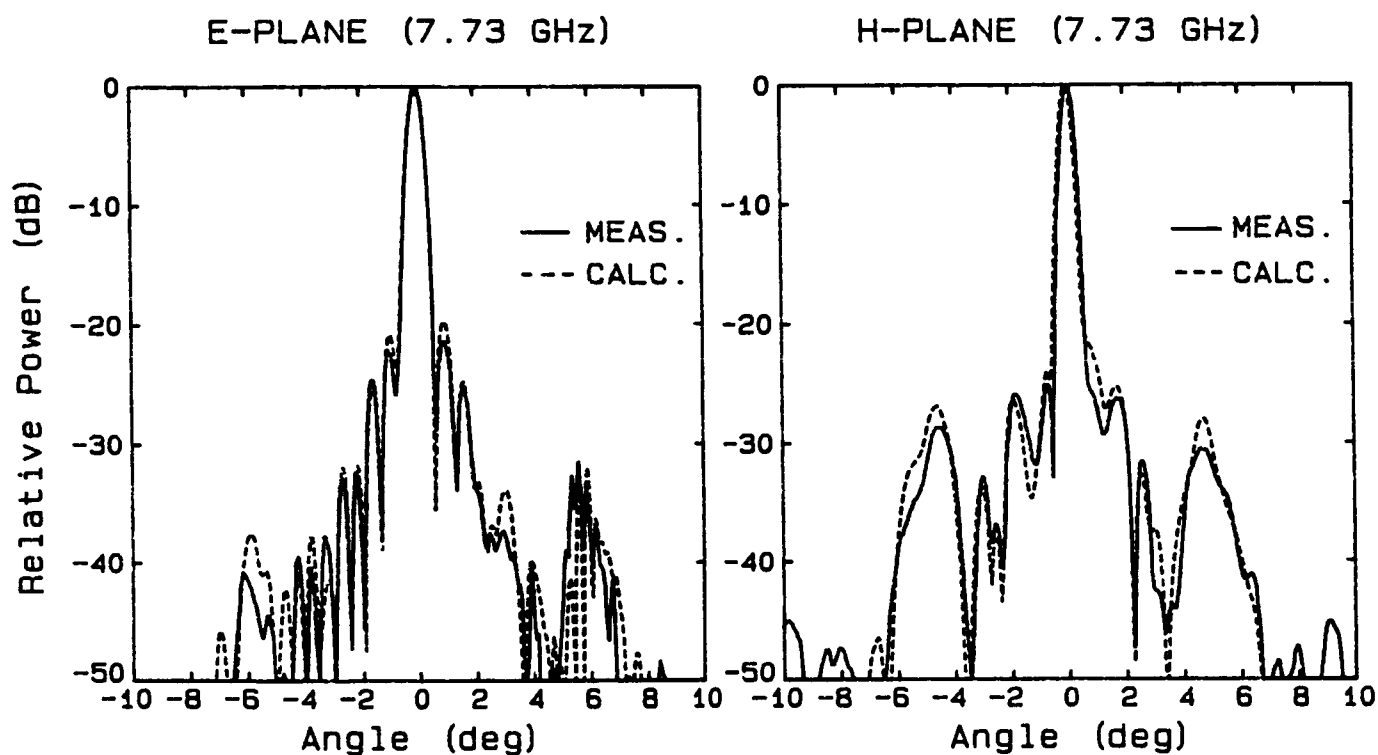
4.26-GHZ RADIATION PATTERNS FOR THE HOOP/COLUMN ANTENNA

At 4.26 GHz, the H-plane radiation pattern shows the formation of two sidelobes symmetrically located about the main beam. These lobes are characteristic of periodic errors in an antenna, or referred to as "grating" lobes.



7.73-GHZ RADIATION PATTERNS FOR THE HOOP/COLUMN ANTENNA

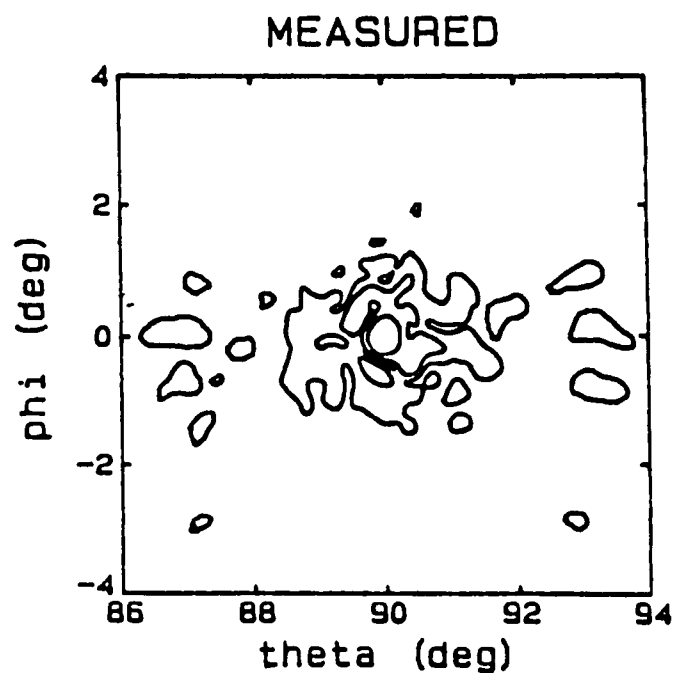
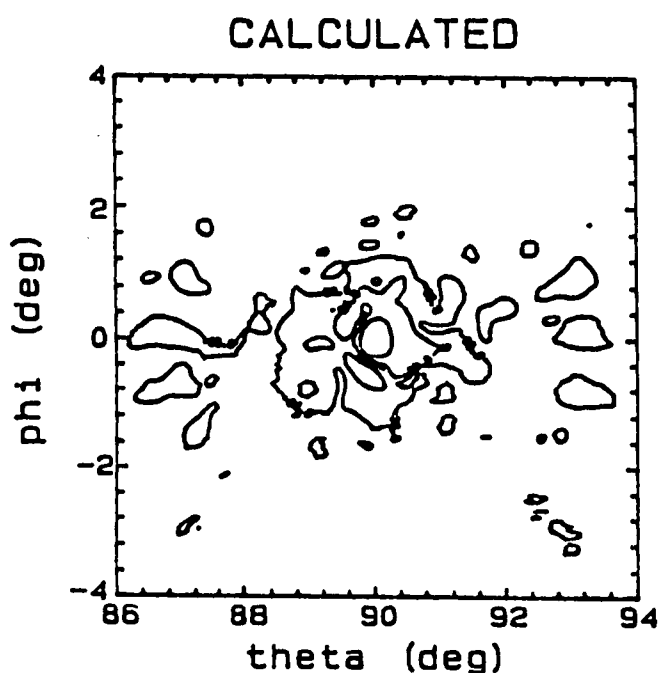
At higher frequencies, these "grating" lobes increase in height and move closer to the main beam. In addition, the E-plane also shows sidelobes symmetrically located about the main beam and at a much lower level. One of these lobes (+6 degrees) in the E-plane shows some interference due to feed spillover onto the opposite quadrant of the reflector.



11.6-GHZ RADIATION PATTERNS FOR THE HOOP/COLUMN ANTENNA

The contour plots of the radiation patterns show the "grating" lobes are actually several lobes located in a circular arc about the main beam. This arrangement of the "grating" lobes is due to the ripple in the surface being periodic in the circumferential direction rather than in a linear direction as is characteristic of truly periodic grating lobes.

(11.6 GHz) (10dB increments) (0 to -30dB)



SURFACE DISTORTION FOR THE TETRAHEDRAL TRUSS REFLECTOR ANTENNA

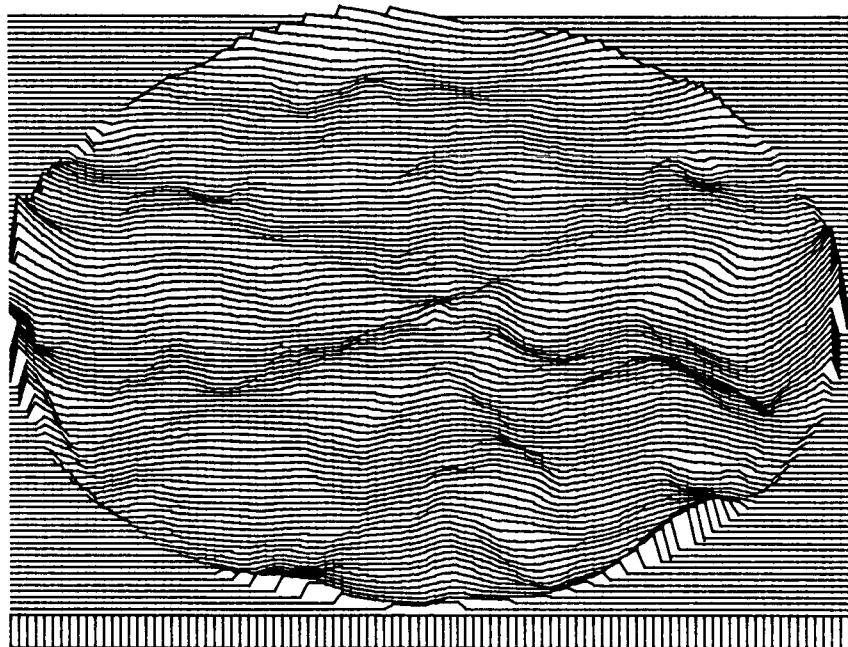
The surface tie-points for the tetrahedral truss reflector were placed more randomly in order to avoid the periodic "pillowing" of the surface. This plot shows the deviation from a perfect paraboloidal surface with the height of the distortion also amplified on the plot.

ORIGINAL PAGE IS
OF POOR QUALITY

(RMS = 0.091 CM)

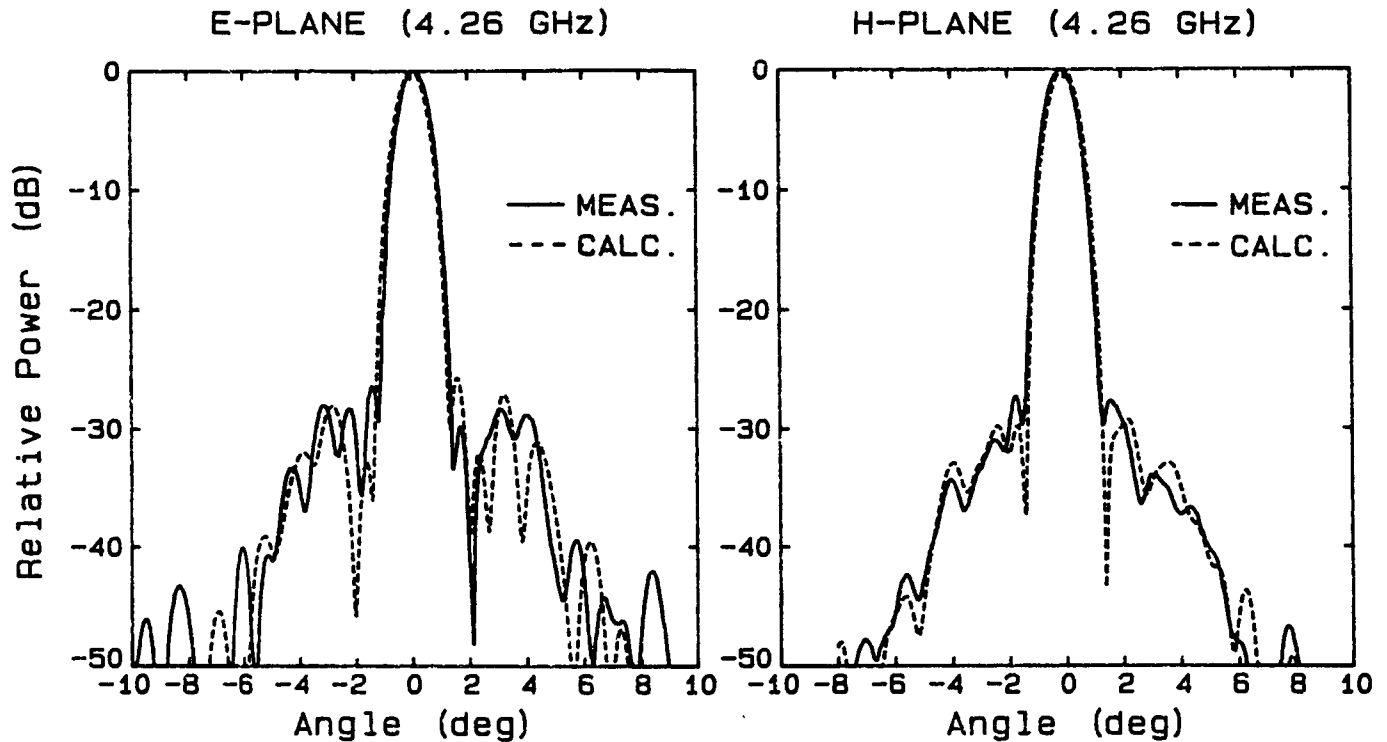
MAXIMUM = +0.60 centimeter

MINIMUM = -0.37 centimeter



4.26-GHZ RADIATION PATTERNS FOR THE TETRAHEDRAL TRUSS ANTENNA

Due to the randomizing of the surface tie-points, the radiation patterns for the tetrahedral truss do not have the "grating" lobes that were characteristic of the hoop/column antenna.

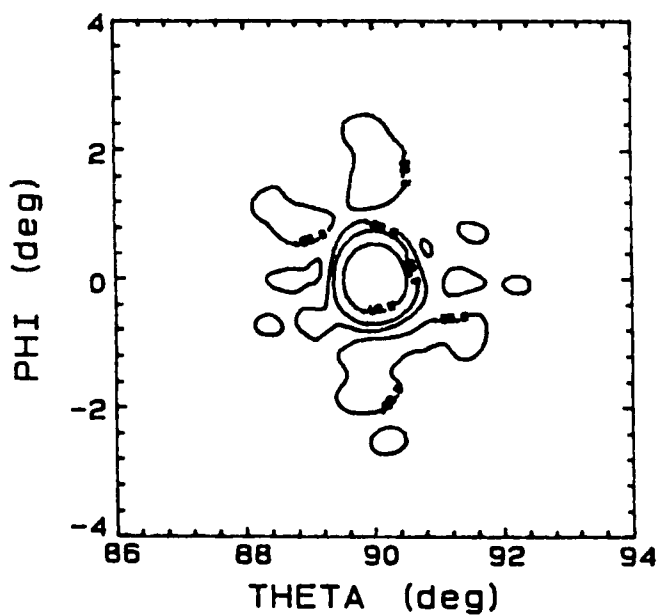


7.73-GHZ RADIATION PATTERNS FOR THE TETRAHEDRAL TRUSS ANTENNA

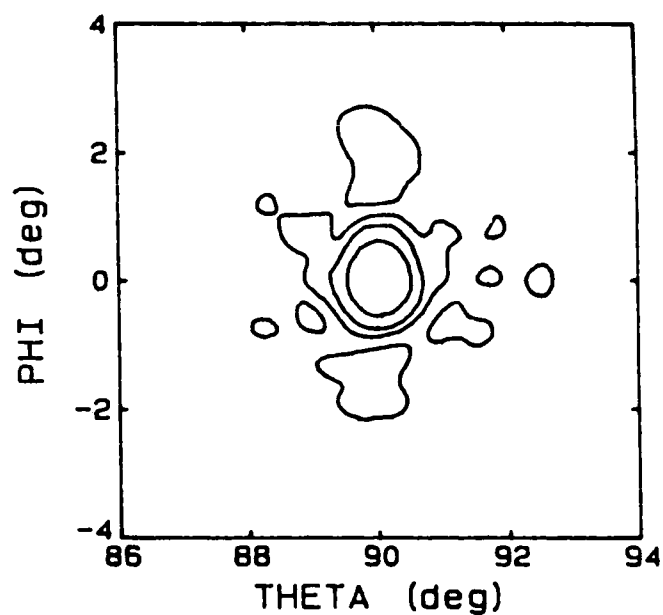
The contour radiation patterns at 7.73 GHz for the tetrahedral truss antenna do show symmetric lobes which appear to be trying to form in a six-fold symmetry about the main beam.

(7.73 GHz) (10dB increments) (0 to -30dB)

CALCULATED



MEASURED



SURFACE DISTORTION CONTOURS FOR THE TETRAHEDRAL TRUSS REFLECTOR

Close examination of the surface distortion contours for the tetrahedral truss antenna indicates that a six-fold symmetry does appear to exist in the surface, thus creating the sidelobe structure observed in the previous radiation patterns.

CONTOUR INTERVALS OF 0.020 INCHES
dashed lines indicate negative contour levels

